

IN THE FIELD

Field Museum
Member Magazine

Vol. 93, No. 3
Fall 2022



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ON THE COVER

Ghanian families honor the dead by burying them in coffins that symbolize something about their life, whether that be a job, skill, hobby, or ambition. For example, this 9-foot canoe-shaped coffin would have been made for a fisherman, and the connection to water can also be a symbol for their passage to the afterlife.

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IN THE FIELD (ISSN #1051-4546) is published three times a year by the Field Museum. Opinions expressed by authors are their own and do not necessarily reflect the policy of the Field Museum. Notification of address change should include an address label and should be sent to Membership.

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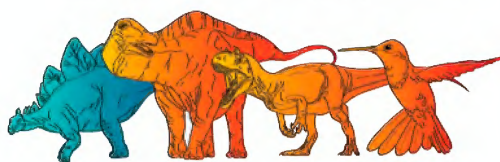
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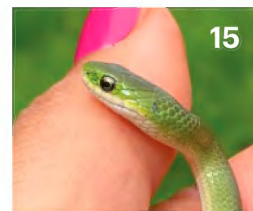
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Dear Friends,



After another remarkable year at the Field, I've been thinking about what sets us apart as a museum. The scope of our collections and research expertise, and the stories that powerful pairing allows us to tell, is vividly illustrated by our line-up of special exhibitions over the course of 2022: *Jurassic Oceans*, *Wild Color*, and now *Death: Life's Greatest Mystery*. (These were joined, of course, by smaller spotlight exhibitions including *Pokagon Potawatomi Black Ash Baskets*, *The Changing Face of Science: Lynika Strozier*, and *Calumet Voices, National Stories*, opening November 11.) *Jurassic Oceans* demonstrated the impact of collaborations with peer institutions, in this case the Natural History Museum of London, to tell compelling stories about our shared world. *Wild Color* drew on the incredible range of our collections in an uplifting exhibition appealing to all ages. And now, *Death* offers an important range of anthropological and biological perspectives on this universal experience.

No other museum could explore these wide-ranging topics in such a thoughtful, scientifically grounded, and enjoyable way. In discussions leading up to the opening of *Death*, for instance, it has become clear that what might seem like a straightforward topic is in fact an invitation to a nuanced, meaningful discussion of what it means to live in this world. Life's greatest mysteries really are underscored in our newest exhibition, which is brought to life by the visitors who engage with it. If you haven't yet seen it, I hope you'll be among these visitors soon.

Your support of our beloved Museum allows us to continue telling these and many more stories. At this time of thanks, I'd like to express my gratitude to you for your membership. I wish you and yours a safe and happy holiday season.

Warm regards,

A handwritten signature in dark ink that reads "Julian Siggers". The signature is fluid and cursive, with a long, sweeping underline that extends to the right.

Julian Siggers, PhD
President and CEO

We want to hear from you!

Help us keep improving *In The Field* by taking 5 minutes to fill out a short survey.

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You can request a paper copy by emailing membership@fieldmuseum.org or provide your answers over the phone by calling 312.665.7700.





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Every day our staff is out in the field and in communities working to protect our land and waters, encouraging our youth to become conservationists, and working with our community scientists to digitize our specimens for scientists and scholars worldwide to use and learn from. Your support makes all of this possible.

Send in the envelope enclosed in this issue or go to fieldmuseum.org/join-give to *Inspire Action* today!



DEATH: LIFE'S GREATEST MYSTERY

By Katie Arnold, *Exhibitions Project Manager*; Ben Miller, *Exhibitions Developer*; and Meredith Whitfield, *Exhibitions Developer*

Death is an incomprehensibly vast subject. The ways that we experience death, celebrate life, and wonder about what's next are part of what makes us. The Field Museum's latest exhibition explores perspectives on death and life through culture, science, and art.

(Below) When a whale dies, it eventually sinks to the bottom of the ocean, where it becomes the foundation of a new ecosystem, like the one seen here. This 10-foot-long diorama shows how the whale's body serves as nutrients and supports hundreds of species for decades.



The Field Museum's newest original exhibition, *Death: Life's Greatest Mystery*, seeks to give visitors a profound new perspective on life's most universal experience. The exhibition is organized around five key questions intended to break down the topic of death. Visitors to the galleries will begin to unpack what death is, what happens to the body and spirit when we die, and how death affects loved ones through scientific and cultural perspectives.

Visitors enter each gallery with a key personal question in mind. Each display poses a possible answer from nature and culture to reinforce or challenge our preconceptions about death.

In addition to biological displays—like a full replica of a whale's body on the ocean floor providing nutrients for nearby organisms—the exhibition includes several cultural stories co-curated and advised by descendant community members. See beautiful objects from the Museum's collections and celebrate life with interactive multimedia.

Additionally, a few stories in the exhibition include specially commissioned artworks, such as an ofrenda by Norma Rios-Sierra (read more on page 11).

Explore traditions and diverse ideas about death and the afterlife through stories from Ancient Egypt to the



Haida Gwaii archipelago. Experience a 9-foot-long fantasy coffin from Ghana meant to honor the dead by celebrating their life.

We hope this exhibition will take a difficult subject matter and allow guests to broaden their understanding of death in a safe and positive space.

***Death: Life's Greatest Mystery* is now open in the Fay and Daniel Levin Hall.**

(Left) This model is a miniature version of the poles you would see on the Haida Gwaii archipelago, where they are used to communicate the lineages and histories of their owners. At Haida Gwaii, raising poles encourages souls to pass on and, ultimately, be reincarnated.

(Below, left) Tardigrades are one of the most resistant creatures known to science. They can survive dehydration and starvation and have been found alive in volcanoes, the deep sea, and even outer space. Tiny but mighty in real life, they're about 0.5 mm (0.020 in) long, roughly the width of two human hairs. This six-foot-long replication details what the human eye can't see without a microscope.

(Below, right) In Mexico, the dead are celebrated and remembered during Day of the Dead (November 1 and 2), where families gather in graveyards with food and drinks to welcome the return of those who have died. Images and figures like this calaca are made by Mexican artists to reflect the everyday activities that somebody's loved ones might have enjoyed in life.





Join the Discovery Squad!

Discovery Squad Volunteers use hands-on objects and inquiry techniques to help visitors explore the Field Museum's collections and its important role in scientific research. Get hands-on training in engagement techniques including questioning, scaffolding, and comparing to engage audiences of all ages. After visiting a Discovery Squad cart or single object, visitors leave feeling curious and wanting to learn more!

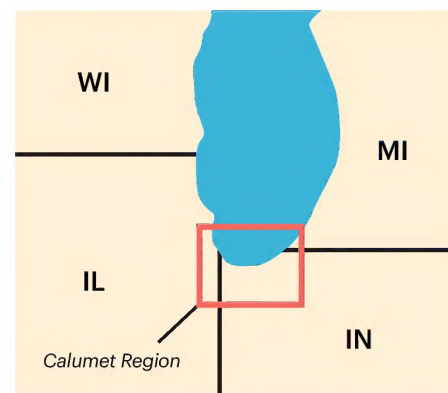
To learn more about volunteering at the Field and to apply, visit fieldmuseum.org/volunteer. Applications for the spring close on Wednesday, January 4.

Discovery Squad volunteers must be at least 18 years of age and have completed high school or equivalent. But, teens and preteens can volunteer at the Field too! Visit www.fieldmuseum.org/teens to learn more.



(Left) Exhibition partner Cassandra Cannon at the opening of the Gary Public Library installation of Calumet Voices.

(Below) The Calumet region spans Lake Michigan's south end, from Chicago to Michigan City, Indiana.



CALUMET VOICES, NATIONAL STORIES

BY MADELEINE TUDOR, SENIOR ENVIRONMENTAL SOCIAL SCIENTIST, KELLER SCIENCE ACTION CENTER

What do steel-toed boots, rare orchids, and a ceramic head have in common? They are all part of the Field Museum's nearly 20,000 objects and specimens from the Calumet region. As the Museum was accessioning global artifacts from the 1893 World's Fair, curators were captivated by a landscape much closer to home. The Calumet region, as it came to be known, has held the Field's gaze ever since. Home to extraordinary biodiversity, colossal industry, and Native American Tribes and immigrants from across the globe, this region encapsulates the changes and challenges of environmental conservation, resource use, and cultural validation faced by our country today. It also embodies the resilience and creativity of sustainable solutions.



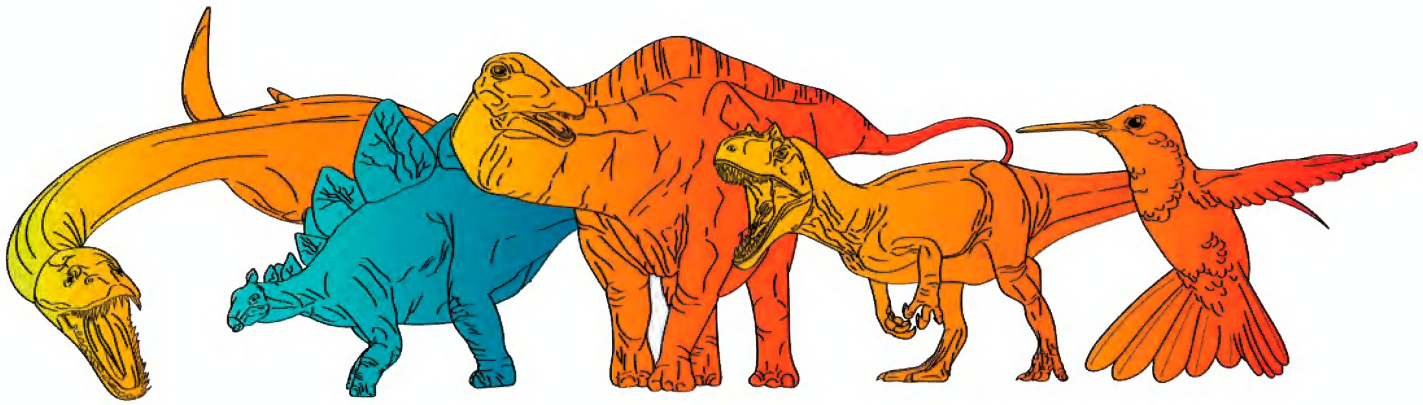
Renowned local artist Roman Villarreal uses recycled material to craft figurines that reflect community life.

Calumet Voices, National Stories showcases this unique region's stories told by those who know it best. Objects from the Field's collection are presented in combination with those from three previous *Calumet Voices* exhibitions which were collaboratively curated by a Field Museum-led partnership of over 15 local museums and history centers.

In this final show, visitors will be immersed in examples of the region's complexity: a set of red-headed woodpeckers whose feathers show changes in air quality relative to industrial pollution; a Potawatomi beaded rattle exquisitely crafted around a Calumet Baking Powder can; and a massive steel plate embossed with the names of women steel workers. In addition to these Field Museum collections, highlights from the previous shows depict milestones in labor and civil rights activism, dedication to environmental justice, and artistic works that interpret the region's beauty and struggle.

An interactive element throughout the exhibition series asks visitors to share their own Calumet stories and memories. Responses then become part of the exhibition to be encountered by future visitors. We invite you to tell your Calumet story—whether it's a memory of a family member who worked in the mills, a visit to the Indiana Dunes, or the experience of living in a new country—all are valued parts of Calumet's story.

Calumet Voices, National Stories opens at the Field Museum on November 11, 2022 in the Gary C. Comer Family Gallery.



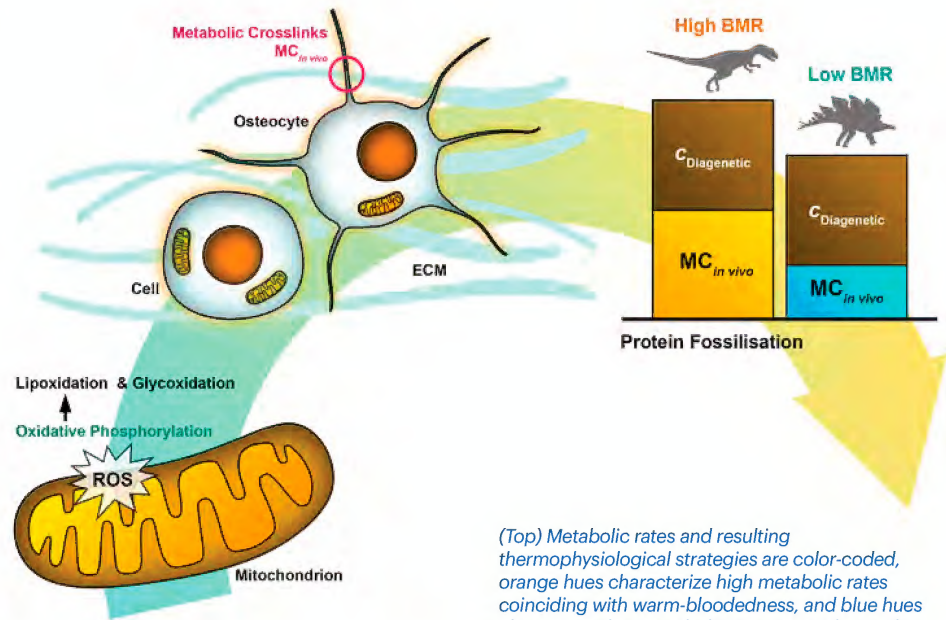
HOT-BLOODED OR COLD-BLOODED: DISCOVERING DINOSAUR METABOLISMS

BY KATE GOLEMBIEWSKI, PUBLIC RELATIONS

For decades, paleontologists have debated whether dinosaurs were warm-blooded, like modern mammals and birds, or cold-blooded, like modern reptiles. Field Museum postdoctoral researcher Matteo Fabbri, PhD, and his colleague (and incoming Field postdoctoral researcher) Jasmina Wiemann, PhD, unveiled a new method for determining dinosaurs' metabolic rates, using clues in their bones.

People sometimes talk about metabolism in terms of how easy it is for someone to stay in good physical shape, but at its core, "metabolism is how effectively we convert the oxygen that we breathe into chemical energy that fuels our body," said Wiemann.

Animals with a high metabolic rate are endothermic, or warm-blooded. These kinds of animals need more oxygen and calories to maintain their body temperature and stay active. Cold-blooded, or ectothermic, animals like reptiles breathe less and eat less. Their lifestyle is less energetically expensive than a hot-blooded animal's, but it comes at a price: cold-blooded animals are reliant on the outside world to keep their bodies at the right temperature to function, and they tend to be less active than warm-blooded creatures.



Since breathing is the key to metabolism, Wiemann and Fabbri looked for biochemical byproducts in fossils left over from the process of breathing. They found that the lizard-hipped dinosaurs, including theropods like *T. rex* and sauropods like titanosaurs, breathed more than the bird-hipped dinosaurs, including *Triceratops* and *Stegosaurus*. This more than likely means that lizard-hipped dinosaurs were hot-blooded,

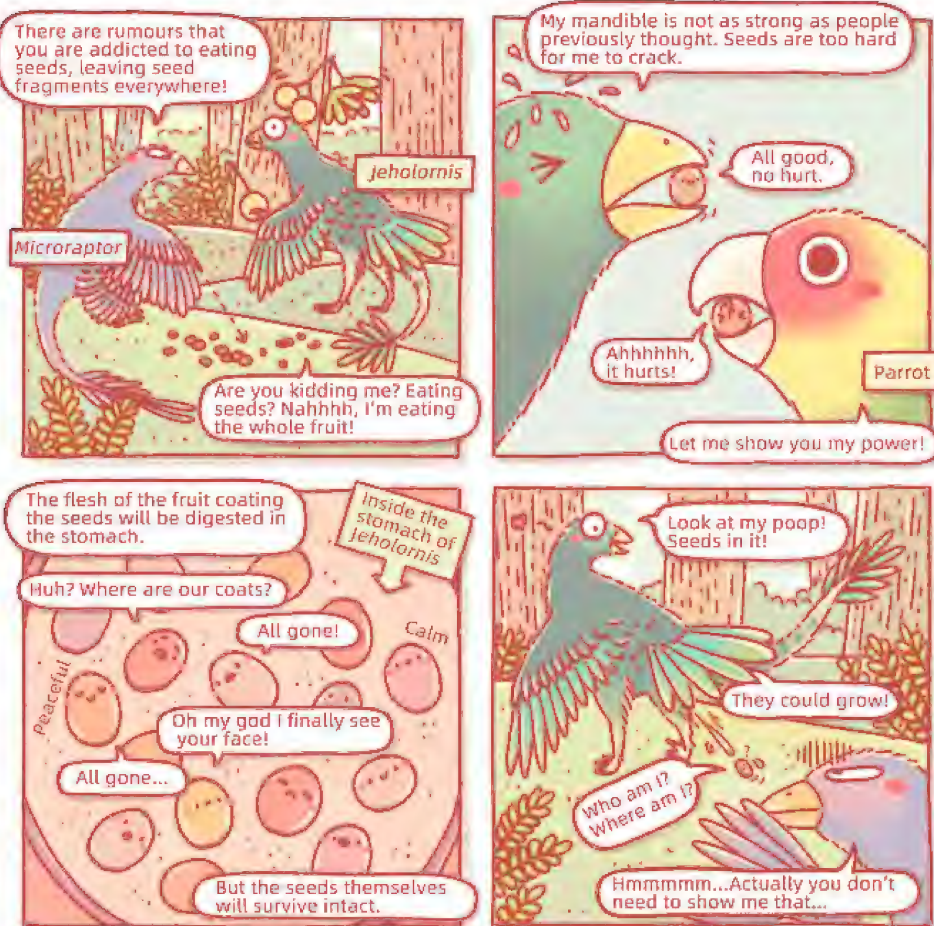
(Top) Metabolic rates and resulting thermophysiological strategies are color-coded, orange hues characterize high metabolic rates coinciding with warm-bloodedness, and blue hues characterize low-metabolic rates coinciding with cold-bloodedness. From left to right: Plesiosaurus, Stegosaurus, Diplodocus, Allosaurus, Calypte (modern hummingbird).

(Above) A graphic summary of the science behind the study. Oxygen respiration (molecular breathing) generates as by-products so-called Reactive Oxygen Species (ROS) at the inner mitochondrial membrane through a process called oxidative phosphorylation. The formation of these unwanted, highly reactive by-products scales in quantity with the amount of oxygen that is converted into chemical energy to fuel physiological reactions.

(Left) Microscopic view of extracted fossilized soft tissue from the bones of an Allosaurus specimen that was investigated for metabolic signals (metabolic crosslinks) in the fossilization products of the proteinaceous bone matrix.

while bird-hipped dinosaurs were cold-blooded.

"Reconstructing the biology and physiology of extinct animals is one of the hardest things we do in paleontology," said Fabbri. "This new study adds a fundamental piece of the puzzle in understanding the evolution of physiology in deep time and complements previous proxies used to investigate these questions."



THE EARLY BIRD GETS THE FRUIT

BY KATE GOLEMBIEWSKI, PUBLIC RELATIONS;
AND KALLIE GROVES, INSTITUTIONAL
ADVANCEMENT

Many animals eat fruit. But most fruit-bearing plants evolved relatively recently in Earth's history. In a new paper in *eLife*, scientists tracked down the first fossil evidence of fruit consumption by comparing the skull shapes and stomach contents of fossil birds. The verdict: the earliest-known fruit-eater was a bird called *Jeholornis* that lived 120 million years ago, and it may have helped contribute to the spread of the plants that dominate the world today.

"Birds are important consumers of fruit today, and play important roles in seed dispersal, but so far there has not been direct evidence of fruit consumption by early birds," said Han Hu, a researcher

at Oxford University and the study's first author. "This obstructs our understanding of the origins of this important plant-animal interaction."

While other birds began evolving tens of millions of years earlier, the second-most primitive known bird was a long-tailed raven-sized creature called *Jeholornis*.

"The first *Jeholornis* fossil that was described in 2002 had plant remains scattered around it," said Jingmai O'Connor, Associate Curator of Fossil Reptiles. "These stomach contents were superficially identified as seeds, so people argued that it was eating seeds. In this study, we wanted to figure out, was it feeding on seeds alone or was it eating fruit?"

Some specimens of *Jeholornis* have been found with gizzard stones, and some have been found with preserved seeds in their gut, but no one's found a *Jeholornis* with both gizzard stones and seeds at same time. What's more, the seeds found in *Jeholornis* stomach cavities are whole, not crushed. These findings suggest that *Jeholornis* was eating different foods at different times of the year. When fruit was

available, it would have eaten whole fruits, seeds and all.

Solving this mystery required Hu to examine dozens of *Jeholornis* specimens at China's Shandong Tianyu Museum of Nature. She selected the one with the best-preserved skull and scanned it at the Australian Nuclear Science and Technology Organisation's (ANSTO) Australian Synchrotron, Melbourne, Australia.

The scan revealed that *Jeholornis*'s skull has many traits that are more like a dinosaur than a modern bird (modern birds are the only surviving group of dinosaurs). However, the skull did have some traits in its mouth and beak, like reduced teeth, that are present in modern birds—features that could potentially hint at a "modern" diet that included fruit.

(Above, left) Cartoon depicting *Jeholornis* eating fruits and pooping out seeds.

(Above, right) The Cretaceous bird *Jeholornis* pooping out seeds from fruit, helping fruit-bearing plants take over the world.



(Left) Skeletal figure reading a book (catalog number 343441), Oaxaca, Mexico, accessioned from the collection of William Goldman.

(Below) In this piece, created by Alfonso Castillo Orta, frogs—associated with life and fertility throughout Mexico—cover a skull, a symbol of death.



FIELD MUSEUM, MICHELLE KUO

FIELD MUSEUM, PAM GABLE

CELEBRATE THE DEAD

BY GARY M. FEINMAN, PHD, MACARTHUR CURATOR OF ANTHROPOLOGY

At the start of November, Mexican families and their descendants around the globe visit cemeteries to commune with their ancestors and deceased loved ones during Day of the Dead (*Día de los Muertos*). Traditionally, flowers, food, and other presents are brought as gifts to the resting places of the dead, music is played, and families pay their respects, celebrate, and remember those who are gone.

To honor the dead, *ofrendas*, or altars, are constructed in homes. The tone of the remembrances is respectful yet,

at the same time, whimsical. *Ofrendas* often include images and figures that inspire memories of the deceased, and they typically incorporate *calaveras* (skeletons). This tradition has stirred a creative explosion of art and artifacts, so much so that the tradition was listed by UNESCO as an intangible Cultural Heritage of Humanity in 2008.

Having conducted archaeological research in Mexico since the 1970s, I have observed and been inspired by the daily communications that take place between the living and the dead. And, since coming to the Field Museum in 1999, I have had the chance to build our collections related to this celebration through the generosity of knowledgeable collectors, including William Goldman and others, who left their artistic treasures to the museum.

The objects in the Field's collection reflect the whimsy of Day of the Dead art and remembrances. The Man reading the Book (above left) acquired from the Goldman collection and created in Oaxaca, likely honors an avid reader.

Explore several pieces from the Field's Day of the Dead collection in our newest exhibition **Death: Life's Greatest Mystery**.

Chicago ofrenda artist, Norma Rios-Sierra, in front of a community ofrenda.



© NORMA RIOS-SIERRA

Artist Spotlight:

NORMA RIOS-SIERRA

BY KATIE ARNOLD, EXHIBITIONS PROJECT MANAGER

For local Chicago artist, Norma Rios-Sierra, the creation of ofrendas is deeply personal. An ofrenda, or altar, is a physical display or offering in honor of deceased loved ones that is created every year for *Día de los Muertos* (Day of the Dead). These displays, which can be created for the home or for a community, include personal or favorite items for those who have passed. “What things would they have loved?” is the question that Rios-Sierra always asks while making an ofrenda. “It’s not about fancy things. It’s about putting things on the altar that the deceased would have loved. When done well, there is always a moment when you feel like they would want to come back to see their altar.”

Rios-Sierra is an ofrenda expert. She has made ofrendas all over Chicago, in her

home, and for community celebrations in collaboration with Palenque LSNA and Comfort Station in Logan Square. She also offers sugar skull making classes through her studio Mosaico Arte Chicago. Before becoming a full-time artist, Norma worked for many years in banking until she had the opportunity to teach a workshop on mosaics. She soon found herself receiving many orders for sugar skulls and offers to teach classes. “It’s a gift that I am able to do this work with so much passion and energy. It never feels like work. It’s beginning to feel like my destiny.”

For her, this work has provided a platform not just to share her art, but her Mexican heritage. It has also allowed her to be an advocate for the Latino community. “Growing up as a Latina immigrant, it was hurtful to live in a world that didn’t feel like it accepted me. It’s incredibly healing and motivating that I now get to live freely and embrace my culture. I just want to keep doing the work.”

Rios-Sierra’s work will be on display in the new exhibition, *Death: Life’s Greatest Mystery*. A new ofrenda created for the exhibition has a particularly personal connection. She created it for her father, who inspired Rios-Sierra to pursue her

passion as an artist. He passed away in January of 2021. “One of the last conversations I had with my dad was what he wanted on his ofrenda. It’s such an incredible honor for my family to share our ofrenda with a museum in Chicago.”



(Above) Norma and her son, Santi, on Armitage Avenue showcasing some of their work with Palenque LSNA, July 2019.

© NORMA RIOS-SIERRA

DEEP-SEA WARTS

BY JANET VOIGHT, PHD, ASSOCIATE CURATOR INVERTEBRATE ZOOLOGY, NEGAUNEE INTEGRATIVE RESEARCH CENTER; AND BRIAN PENNEY, PHD, PROFESSOR OF BIOLOGY, ST. ANSELM COLLEGE

The skin of octopuses is renowned for its ability to change both its color and texture to camouflage the animal. What is the skin of deep-sea octopuses like? In one kind of deep-sea octopus, it's warty. Since there's no light in the deep sea, it's not for camouflage. But, we found something even weirder, Pacific warty octopus, *Graneledone pacifica*, from deeper (near 2700 m or 8860 ft) in the range are wartier than are those from shallower depths (1100 m or 3610 ft), regardless of their size. To figure out why, we had to look at them in a new way.

Brian is skilled in histology, the science of looking at the insides of tissues by slicing them ultra-thin, then staining different types of cells in different colors. Looking at the ultra-thin, stained sections under a microscope reveals what makes up structures. In this case, working with two

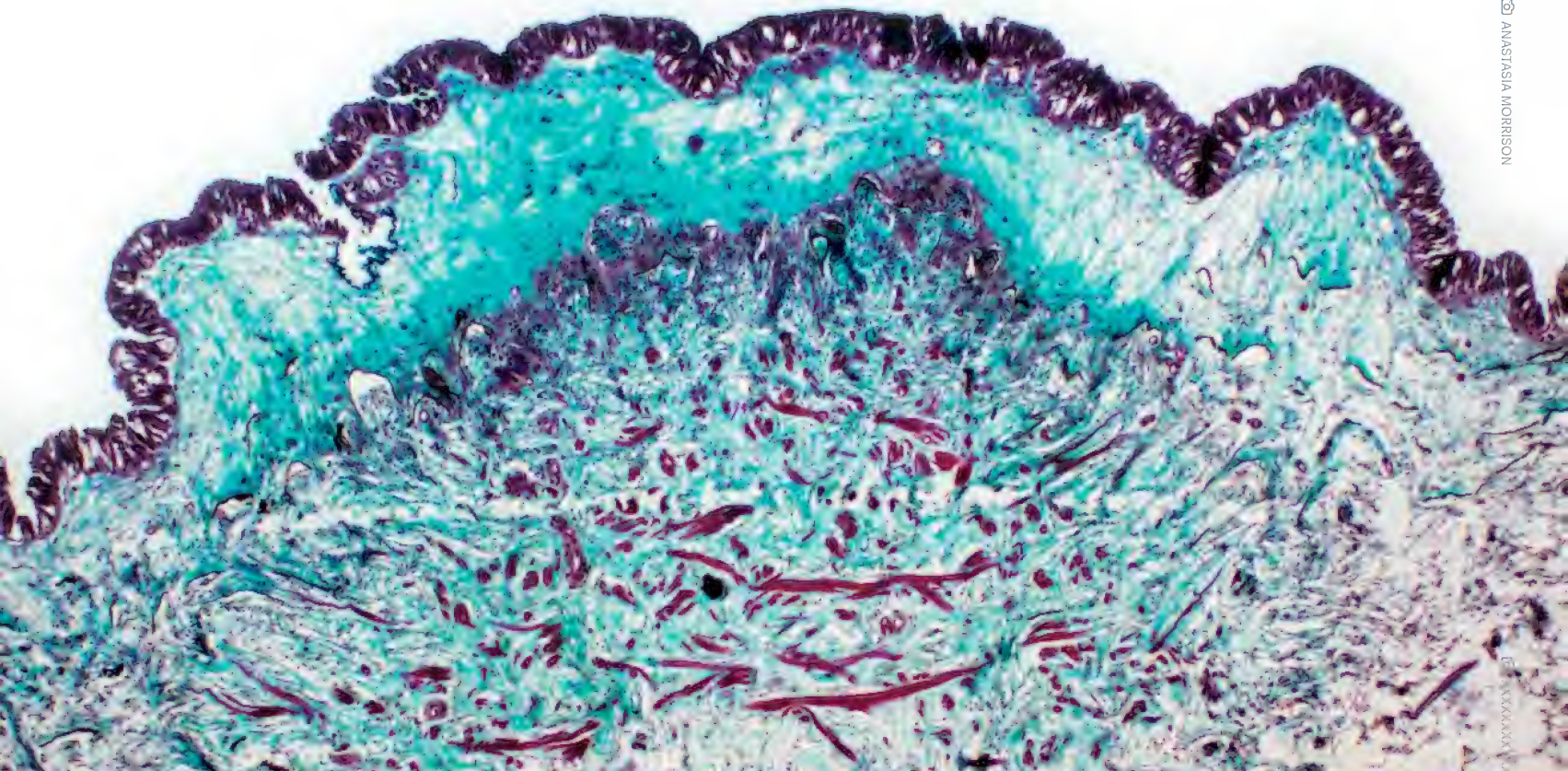
research students, Gina Genovese and Anastasia Morrison, we found the warts are amorphous connective tissue with just a little muscle, a fancy way of saying a whole bunch of not much. Amorphous tissue contains a lot of water and big, but inert, molecules. It doesn't cost much for the octopus bodies to make, and it doesn't use energy.

Why have warts at all? We think *Graneledone* warts were inherited from ancestral shallow-water octopuses. Shallow-water octopuses often have bumps with changeable shapes as part of their camouflage. The muscles that ring these bumps contort them, like a fist deforms a water bead stress ball. We know that the deeper the *Graneledone* octopus lives, the scarcer their prey (except at hydrothermal vents, and near whale corpses on the seafloor, but these are tiny areas!). Perhaps the deeper octopuses minimize the amount of energy-using tissue they have by making more, bigger bundles of amorphous tissue. These bundles not only save energy, they fill space, making the octopus bigger, which is safer. Maybe there is another reason that we just haven't figured out yet, or in fact no reason at all!



(Above) *Graneledone pacifica* on the Cascadia Basin seafloor near 2660 m depth.

(Below) A section through a wart of *Graneledone pacifica* at 40X magnification. Blue areas are amorphous connective tissue; magenta streaks are muscle fibers. A deep purple layer of epidermal cells sits on top, and an open network of collagen fibers can be seen to the right of the wart structure.



REMOOTELY OPERATED VEHICLE JASON

ANASTASIA MORRISON

From the Seashore to the Seafloor

Conservationists have long known that people won't protect what they don't love and won't love something they don't understand. How can we help people understand, and even love, the unknown? Associate Curator Janet Voight teamed up with Artist-in-Residence Peggy Macnamara to demystify the oceans in *From the Seashore to the Seafloor: An Illustrated Tour of Sandy Beaches, Kelp Forests, Coral Reefs, and Life in the Ocean's Depths*, recently published by the University of Chicago Press.

As long-time Field Museum members may recall, Voight has been lucky enough to explore the bottom of the ocean on twenty-two research cruises and has dived eight times in the Human-Occupied Vehicle *Alvin*. She has built Field Museum collections to enhance our knowledge of the largest and least known habitat on the planet. In this beautifully illustrated

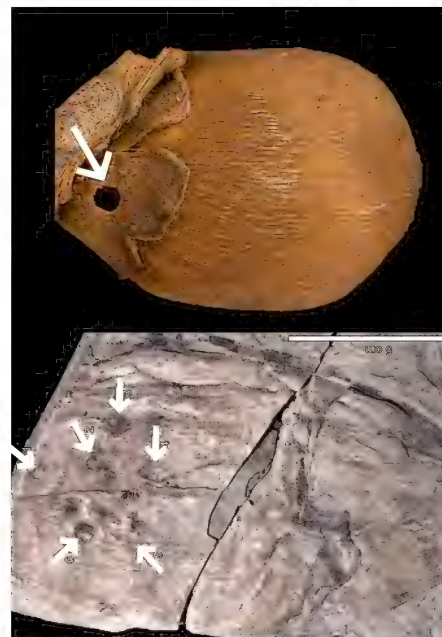


Get your copy of *From the Seashore to the Seafloor* at the Field Museum store or online at store.fieldmuseum.org.

book, Voight writes about the places that are special to her, inviting readers of all ages to share her wonder of these amazing places and their animals. Peggy Macnamara's beautiful watercolors illuminate these scenes as only she can.

(Below) Coral reef with sea turtles and fishes—including a stylized blue angelfish (far right), southern scythe butterflyfish (middle right), rainbow wrasse (bottom right), and several sergeant majors (left)—swimming around reef-building corals.





TALES FROM THE OLDEST SOUTH AMERICAN RAINFOREST

BY **FABIANY HERRERA, PHD**, ASSISTANT
CURATOR OF PALEOBOTANY, NEGAUNEE
INTEGRATIVE RESEARCH CENTER

Sixty million years ago, tiny beetles tunneled their way into coconuts for a healthy snack in what today occupies the northernmost part of South America (Guajira Peninsula, Colombia). We know this because of a curious fossil coconut. While my colleagues and I were studying this specimen, we identified palm seed beetle tunnels—based on the plant's reaction tissue and the size, number, and position of the tunnels in the fossil coconut.

After studying the damage in detail, my colleague L. Alejandro Giraldo, a Penn State graduate student, was able to pinpoint the insect culprit: a group of beetles commonly referred to as palm bruchines that today still eat lots of palm fruit—coconuts included.

Today, female palm bruchines lay eggs on the coconut surface. The larva then bores into the seed cavity. While inside, the insect molts into a legless grub and feeds on the coconut's nutritious tissues. Before pupation, the larva excavates a round exit hole that the emerging adult finishes. This occurrence provides the earliest record of an ecological interaction between seed beetles and palms, suggesting that this host-specific interaction has been consistently maintained for millions of years in tropical South America.

This is but one of many fossil discoveries my colleagues and I have uncovered from Paleocene Colombia (~60 million years ago). Thousands of fossils have been collected for almost two decades from coal and clay mines across the South American country—including leaves, fruits, seeds, flowers, and pollen. Many of these

plants are the first evidence of legumes, avocados, aroids, and many other groups that dominate the South American tropical forests. All fossil plants and the remarkable insect damage left on them support the oldest fossil evidence of a neotropical rainforest. These 60-million-year-old fossils show us that rainforests have existed in northern South America for a very long time.

Scan this QR
code to learn
more about
seed beetle
predation on
coconuts:



(Above, left) Fossil plants from the Cerrejón flora of Colombia. Most fossil plants can be compared to living plants of the neotropical forests.

(Above, right) Living palm coconut with a circular hole caused by seed beetle.

© F. HERRERA

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FIELD MUSEUM RESEARCHERS GRANTED WALDER BIOTA AWARD

BY SARA RUANE, PHD, WOMEN'S BOARD ASSISTANT CURATOR OF HERPETOLOGY, NEGAUNEE INTEGRATIVE RESEARCH CENTER; AND MICHELLE THOMPSON, PHD, CONSERVATION ECOLOGIST, KELLER SCIENCE ACTION CENTER

This year, we were granted a Walder Biota Award to conduct three years of biological surveys of Will County's reptiles and amphibians. With 40+ species, Will County boasts the greatest number of reptile and amphibian species in the Chicagoland region. In addition, the Forest Preserves of Will County have been previously surveyed, meaning that these new efforts allow us to determine how species have persisted, declined, or even been extirpated across the county over the past 10-30 years. Resurvey efforts like these provide valuable long-term data that is often key for the conservation and management of species. In addition to the two of us, the project relies on close

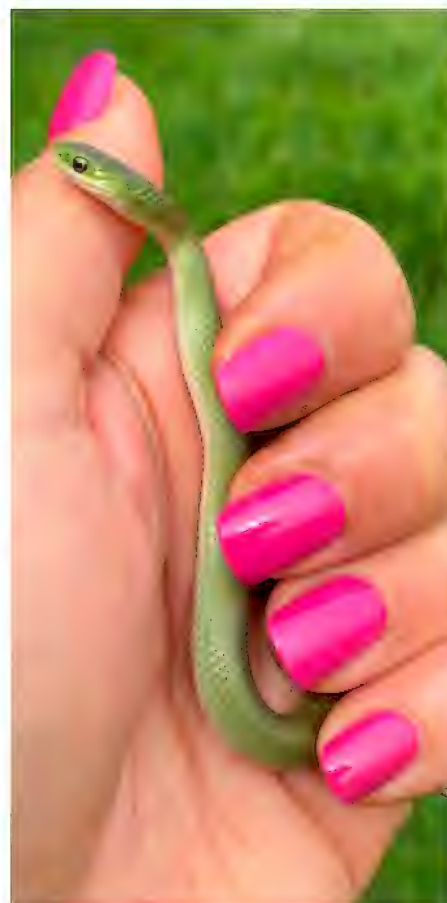
collaboration with the Will County Forest Preserve land management team and includes five interns who are working at the preserves daily all summer to find and collect reptiles and amphibians they encounter and check traps, which include coverboards (sheets of plywood or rubber that snakes love to hide under) and drift fences, where animals follow along until they end up "drifting" into a trap that holds them until collected. Collected animals are recorded daily, with a subset having vouchers and genetic samples placed into the Field Museum's collection for future research work.

The best part of this project is actually getting out and doing local fieldwork. Having only recently moved to the region, this is a great way for us to immediately get a good look at local herpetofauna. And we think that's what makes the project so awesome in general, that we have an opportunity to work with interns and educate anyone who wants to know more about the reptiles and amphibians you can find right here in the area, essentially the suburbs of Chicago.

Within the sea of Chicagoland's extensive urban and suburban sprawl, the forest preserves act as refuge spaces for both nature and people. Getting out in the preserves and seeing how amphibian and reptile populations are holding on and in some cases thriving highlights the importance of these preserves for maintaining biodiversity in urban areas.

At the same time, many of these preserves are highly used by people and so these spaces provide a great way to understand how human use of land and conservation of biodiversity are compatible.

Sawyer Markham, one of the interns on the project said, "For me, the most exciting part of this project is encountering species that we haven't seen previously. When you live in a city as big as Chicago, you might not realize just how many different animals take advantage of the natural resources in this region."



(Above) A smooth green snake found under a cover board.

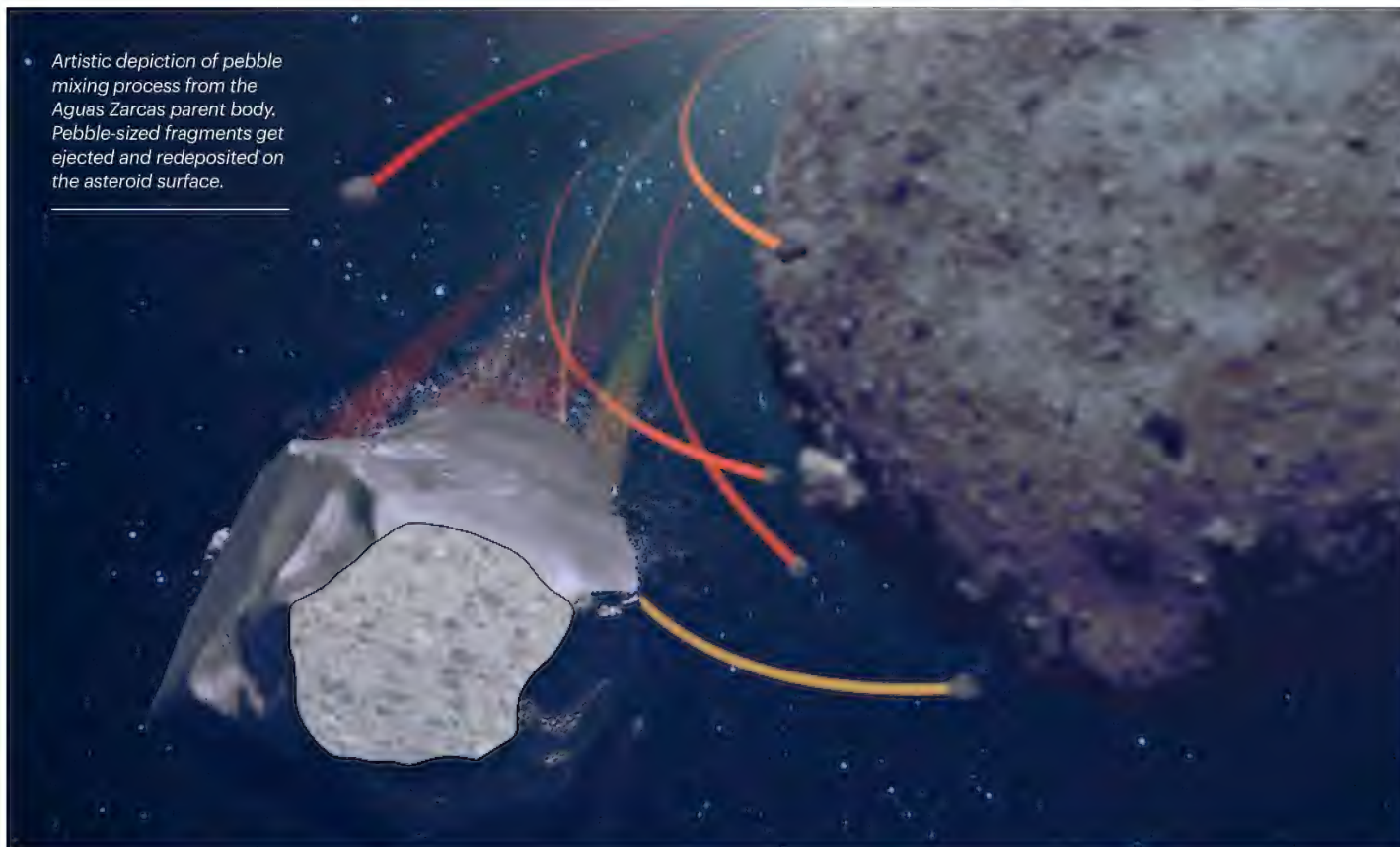
(Left) Sara Ruane showing an intern a fox snake at one of the field sites.



© SARA RUANE

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Artistic depiction of pebble mixing process from the Aguas Zarcas parent body. Pebble-sized fragments get ejected and redeposited on the asteroid surface.



APRIL 1. NEANDER. ASTEROID IMAGE: NASA/GODDARD/UNIVERSITY OF ARIZONA

ASTEROIDS ARE SPITTING OUT PEBBLES?

BY KATE GOLEMBIEWSKI, PUBLIC RELATIONS;
AND KALLIE GROVES, INSTITUTIONAL
ADVANCEMENT

In 2019, NASA's Osiris-REx spacecraft sent scientists stunning images of a strange phenomenon taking place on the surface of the asteroid Bennu. The asteroid appeared to be shooting off swarms of marble-sized rocks, something that had never been observed before.

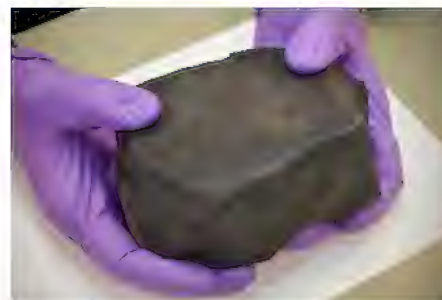
In a new paper in *Nature Astronomy*, researchers show the first evidence of this process in a meteorite that fell to Earth in 2019. Philipp Heck, PhD, Robert A. Pritzker Curator of Meteoritics at the Field Museum and his student, Xin Yang, a graduate student at University of Chicago, were preparing the meteorite for another study when they noticed something strange.

"We were trying to isolate very tiny minerals from the meteorite by freezing

it with liquid nitrogen and thawing it with warm water to break it up," said Yang. "That works for most meteorites, but this one was kind of weird—we found some compact fragments that wouldn't break apart." The researchers devised a plan to learn what these pebbles were and why they were so resistant to breaking.

"We did CT scans to see how the pebbles compared to the other rocks making up the meteorite," said Heck. "What was striking was that these components were all squished—normally, they'd be spherical—and they all had the same orientation. They were all deformed in the same direction, by one process."

The 2019 OSIRIS-REx images gave the researchers a clue of what this process might have been. They hypothesized the asteroid underwent a high-speed collision that deformed the area of impact. The deformed rock eventually broke apart due to the temperature differences the asteroid experiences when it rotates—the side facing the sun is more than 300° F warmer than the side facing away. "This constant thermal cycling makes the rock brittle, and breaks it apart into gravel," says Heck. This gravel got ejected from the asteroid's surface, entered a very



FIELD MUSEUM, JOHN WEINSTEIN

slow orbit, and eventually fell back down to its surface.

"It provides a new way of explaining how minerals on the surfaces of asteroids become mixed," said Yang. For a long time, scientists assumed minerals on the surfaces of asteroids are rearranged through big crashes, which don't happen very often. "From OSIRIS-REx we know that these particle ejection events are much more frequent than these high-velocity impacts," said Heck, "so they probably play a more important role in determining the makeup of asteroids and meteorites."

(Above) The main mass of the Aguas Zarcas meteorite at the Field Museum.

(Below) Artist Jason Wesaw (Pokagon Band of Potawatomi) gives a demonstration about basketry in the Grainger Science Hub.

Celebrate Native American Heritage at the Field!

November is Native American Heritage Month. Join us in the Museum and online to celebrate the diversity of values, traditions, and languages that make up the rich cultures of Native American communities. Hear from staff and guest speakers about the objects and issues at the heart of Native histories and contemporary experiences.



Opening Ceremony with Dave Spencer

November 1st, 1:30pm
Rice Native Gardens (weather permitting)

Native Heritage Month Celebration

November 12th, 11am–2pm
Stanley Field Hall and *Native Truths: Our Voices, Our Stories*

Join us for a large celebration including Native American performers and storytellers.

Meet a Museum Insider

Join us on Wednesday afternoons for an up-close look at what Field staff members do every day. This series is live-streamed on Facebook, where you can ask your questions in real time.

Indigenous Language Labels

This year, the Sauk language will be added to the list of Indigenous languages represented on display cases throughout the museum. Learn the names of familiar specimens in Cherokee, Diné, Ojibwe, Sauk, and Spanish.

(Left) Experience stories told by Native people of self-determination, resilience, continuity, and the future in *Native Truths: Our Voices, Our Stories*.





JOHN BATES

WHAT BIRDS CAN TEACH US ABOUT CLIMATE CHANGE

BY JOHN BATES, PHD, CURATOR OF BIRDS, NEGAUNEE INTEGRATIVE RESEARCH CENTER

The value of our collections lies not only in those at the Field Museum but also in a network of collections-based organizations whose impact is increasing. In a recent paper on changes in annual egg-laying dates in 72 species of Illinois birds, my colleagues and I used data from various egg collections, including the one at the Field, to show that many species (e.g., Killdeer, Cedar Waxwing, and Yellow-billed Cuckoo) have moved their egg-laying dates forward as much as a month over the last 142 years. We also found that many other species included in the study (e.g., Blue Jay, Eastern Phoebe, and Red-eyed Vireo)

have not changed. Counter to our initial hypothesis, whether species were resident, short-distance migrants, or long-distance migrants did not predict if lay dates had shifted forward. We expected resident birds would be better able to shift, whereas long-distance migrants might not. Our results highlight how much more we need to learn about the details of the life histories of each species to understand how they are coping with changing climates in the Midwest and elsewhere.

Eggs represent the neonatal stage for birds and, just as we do for humans, we need to gather data on this life stage. Egg collecting for museums in North America largely stopped around 1930, which means we lack modern egg specimens in our collections. The modern data on egg-laying dates for our study came from data gathered by my co-authors doing local fieldwork, including long-time Birds Research Associate Bill Strausberger, who gathered similar data through nest observations over the last 35 years. Like recent studies using our collections of salvaged specimens to document decreasing body size in many birds, this new study illustrates how critical

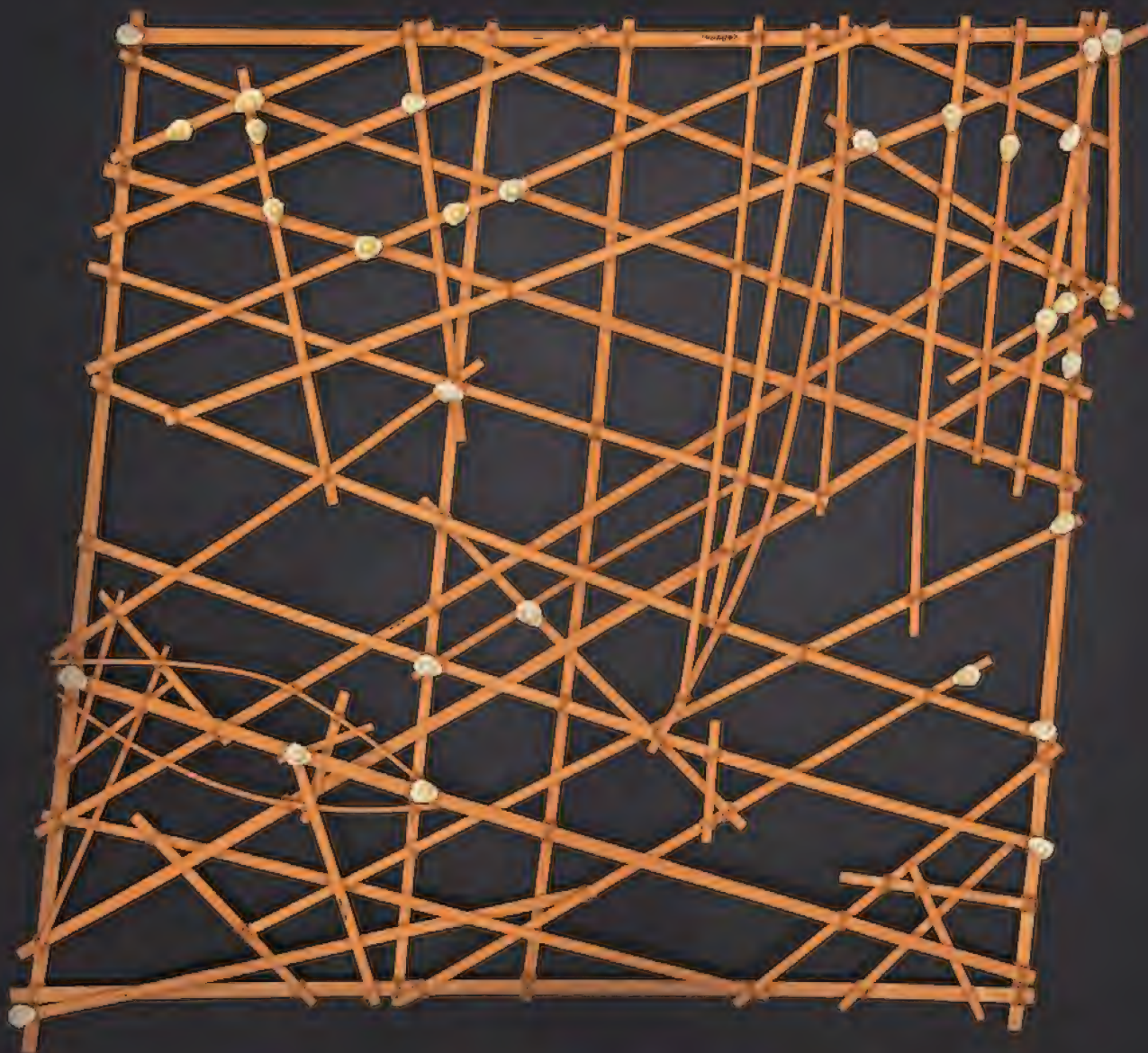
specimens and their data are to studying change over time. Where will researchers go in another 100 years to study these questions? Museums are the obvious answer.



JOHN BATES

(Top) Clutches of bird eggs in the Field Museum collection. Most of these sets were collected before 1930.

(Above) An egg laid by an American Robin in a Chicago area nest. In our study, Robins were one of only two species found to be laying their eggs later on average over the time span of the study, which may be related to how well they have adjusted to urbanization in the Midwest.



Specimen Spotlight:

Navigating without a GPS

The Marshallese, renowned for their sailing skills, used *meto*, instructional stick charts like this, as memory devices in teaching and training navigators how to read the ocean before setting sail. The Republic of the Marshall Islands is today spread out across 750,000 square miles of Pacific Ocean and comprised of 29 coral atolls and 5 islands. This square variety: *rebbelib* (pronounced: rebel – hip) is constructed from thin strips of pandanus root or coconut palm leaf midribs and 30 cowrie shells (*Cypraea moneta* L.) attached by string. The seashells represent the different atolls or islands and their locations in the Ratak (sunrise) and Ralik (sunset) island chains. Straight and curved sticks represent waves around atolls, currents, and ocean swells. Expert sailors could navigate between islands just by following the stars and wave patterns alone and charts like this helped preserve and pass on that knowledge. This chart is from Majuro Atoll and was acquired from Dr. Marvin Montvel-Cohen in 1977.

(Catalog Number 3346.268406)

See this beautiful *rebbelib* and other materials from the Marshall Islands in *Home is Where the Jaki Is*, located in the Regenstein Hall of the Pacific, before it closes on April 30, 2023.

EXTINCT NO MORE!

BY **DAWSON M. WHITE, PHD**, NATIONAL SCIENCE FOUNDATION POSTDOCTORAL RESEARCH FELLOW, NEGAUNEE INTEGRATIVE RESEARCH CENTER; AND **NIGEL C. A. PITMAN, PHD**, MELLON SENIOR CONSERVATION ECOLOGIST, KELLER SCIENCE ACTION CENTER

The micro-biodiversity hotspot called Centinela was believed to have suffered the most notorious extinction event of the modern age. A floristic report published in 1991 described an isolated mountain ridge on the coast of Ecuador, coated in cloud forest and rising above a sea of lowland banana and cacao plantations. Centinela (“Sentinel”) held an extraordinary diversity of plants, the authors claimed, with a jaw-dropping 90 species that were new to science and existed nowhere else on the planet. They concluded, however, that since their initial inventory, the forests of Centinela had been destroyed and converted to agriculture.

After reading this report, Edward O. Wilson—American zoologist, naturalist, and writer (1929-2021)—coined the term “Centinelan extinctions” in his 1992 book *The Diversity of Life* to describe the hemorrhagic loss of diversity that occurs when forests holding unique, local species are clear-cut. However, with so much other work to do, few researchers ever returned to Centinela, and no one published on it...until now.

Thanks to funding from the Field Museum Women’s Board and Grainger Bioinformatics Center, we assembled a team of 12 botanists representing eight institutions and traveled to Centinela in November 2021 to finally see if any of Centinela’s unique species or any forest at all had survived.

In our three days on the ridge, we found numerous small, healthy forest remnants and one large patch sustaining a population of howler monkeys. We collected drone imagery and over 250 plant specimens for the Field Museum and Ecuadorian herbaria. We also found the flag-bearer of Centinelan extinction, a stunning herb with large, neon-orange flowers called *Gasteranthus extinctus*—a plant last collected 37 years ago and named after its own presumed extinction. In March 2022, some members of our team returned and found four species



© THOMAS COUVREUR



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new to science, including a new orchid. The story of Centinela is far from over.

We have published our rediscovery of *Gasteranthus extinctus* in the journal *Phytokeys* and generated a webpage to disseminate ongoing discoveries, photos, and opportunities to assist with conservation: bit.ly/vivacentinela. We will continue working to understand

and protect Centinela and we hope you will check out the website and join us in this effort.

(Top) *The very much alive, Gasteranthus extinctus.*

(Above) *Sunset over a forest remnant on the Centinela ridge.*



HONORING DANNY BALETE, PHILIPPINE BIODIVERSITY SCIENTIST AND CONSERVATIONIST

BY LARRY HEANEY, PHD, NEGAUNEE CURATOR OF MAMMALS, NEGAUNEE INTEGRATIVE RESEARCH CENTER

The Philippines is one of the most biodiverse places on the planet. My career has been focused on trying to discover the reasons why. At the start of a field trip to the Philippines in April 1989—soon after I began working at the Field Museum as curator of mammals—I asked Filipino colleagues to recommend a local biologist to accompany me. Several strongly suggested Danny Balete, who was then a recent graduate of the University of the Philippines. Danny proved himself to be a tireless field biologist and naturalist, able to identify virtually every plant, frog, and bug—perhaps because he grew up riding water buffaloes bare-back on his family's tiny farm. He later earned a master's

degree at the University of Illinois Chicago and published over 50 scientific papers.

I was usually able to spend only six weeks each year in the field. As a Research Associate of the Field Museum, Danny quickly became the leader of our field team. In a year, he typically spent four months leading carefully targeted surveys of the remarkably diverse mammals of the Philippines, and four months at the Field Museum working with me on publications that described the results. In the remaining months, he was in great demand to lead assessments of threat status for “red lists” of endangered species and areas to be declared as national parks. He also was sought after as a charismatic instructor at the University of the Philippines for classes in biodiversity and conservation. When he died suddenly in 2017 at age 56, he was among the best-known biodiversity scientists in the Philippines, and widely known for his enthusiastic efforts to promote enjoyment of Philippine biodiversity.

How can we possibly give sufficient recognition to someone who gave so much to an entire nation? Danny and my studies have led to the discovery and description of nearly 50 new, previously unknown species of mammals unique

to the Philippines. In a publication that appeared in the *Journal of Mammalogy*, my colleagues and I named a little mouse so distinctive that it deserves recognition not only as a new species but also as an entirely new genus. We named it *Baletemys kampalili*, which in Latin means “Balete’s mouse from Mt. Kampalili,” a name that will forever characterize this unique species and honor its discoverer.



(Top) Danny Balete (center) and Larry Heaney (far left) with the field team on Mt. Amuyao, northern Luzon in April 2011.

(Above) Drawing of *Baletemys kampalili* by Velizar Simeonovski.



(Left) Dr. Justin Bernstein while in the herpetology collection with jars of snakes he is examining.

(Below) A photo of the Field Museum *Hydrablades periops* specimen, collected in the 1990s in Borneo, that was sequenced.



HOW WE EXTRACT DNA FROM OLD SPECIMENS

BY SARA RUANE, PHD, WOMEN'S BOARD ASSISTANT CURATOR OF HERPETOLOGY, NEGAUNEE INTEGRATIVE RESEARCH CENTER; AND JUSTIN BERNSTEIN, PHD, UNIVERSITY OF KANSAS CENTER FOR GENOMICS

As scientists with a strong focus on the biodiversity of reptiles and amphibians (especially snakes!), we know that museum collections are one of the most valuable resources we have available for our research. A specimen in a collection is a historical record of an individual that occurred at a specific time and place.

These records allow scientists like us to go back in time and better understand the lives of these animals, including where they were in their environment, what they ate, and how much variation was in a population. These data, while collected at a previous point in time, help us understand the biodiversity we see today. Often, the DNA and subsequent analyses are used to reveal even more information about the biology and evolutionary histories of organisms. However, many older museum specimens, collected prior to the advent of DNA sequencing, have been 'fixed' using chemicals, which preserve the specimens but damage the DNA, ultimately precluding us from the treasure box of information that DNA yields.

Recently, we sequenced the degraded DNA from a poorly known snake from Borneo, *Hydrablades periops*. It was collected by the late Field Museum

curator Dato Dr. Robert F Inger and a Field research team of Sabah Parks and Datin Tan Fui Lian. Few specimens of this snake exist in collections and with no fresh tissue samples available, relying on a specimen collected decades ago was the only way we were able to determine its relation to other aquatic snakes in a family called Natricidae (which includes many familiar species such as garter snakes). This lays a foundation for future studies to learn more about how natricids, like *Hydrablades*, adapt to and survive in their environments, and how they got to the locations where they are found.

CAPTIVITY AND ITS IMPACT ON THE BONES OF ZOO ANIMALS

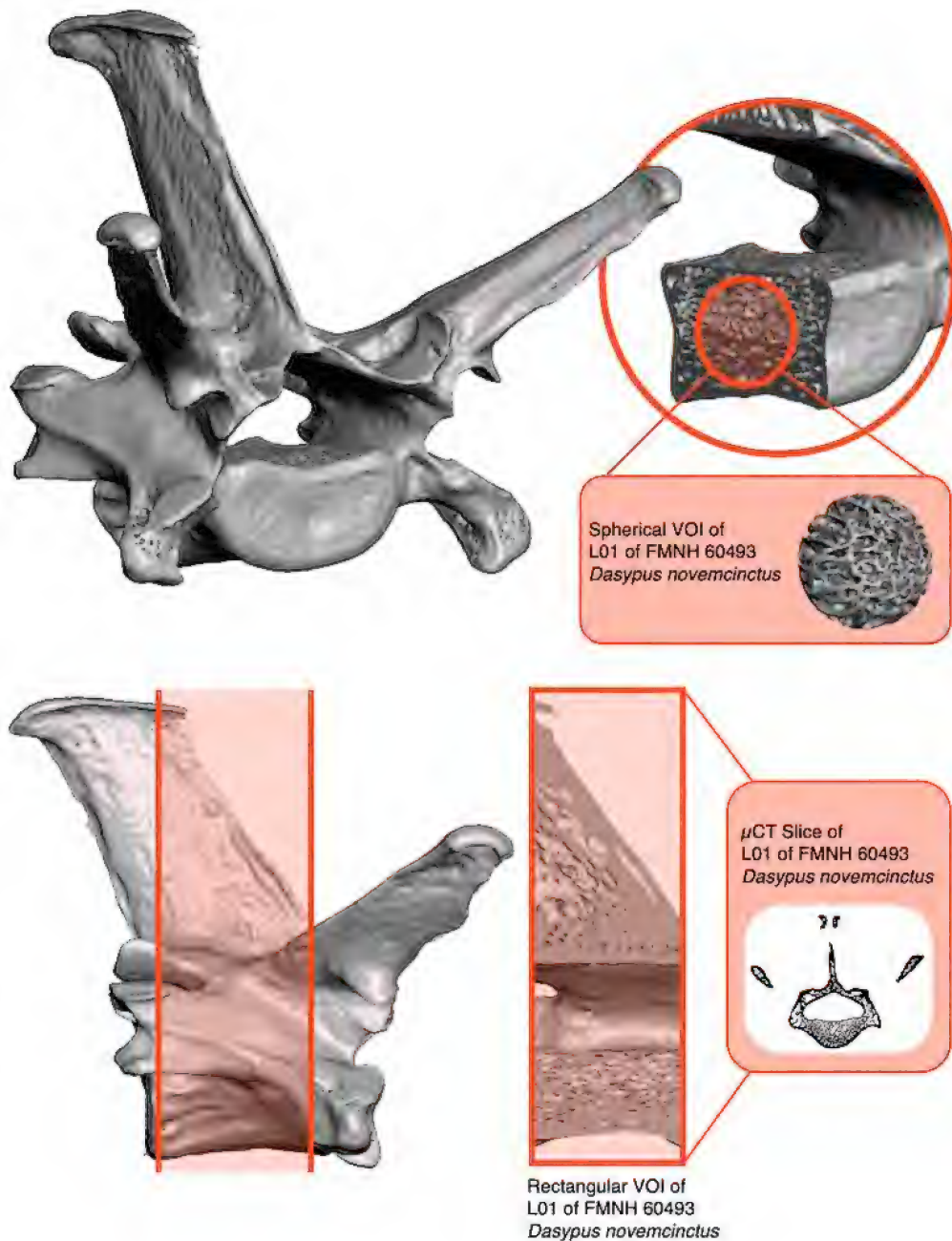
BY HARTRICH ZACK, GRADUATE STUDENT;
KEN ANGIELCZYK, PHD, MACARTHUR CURATOR
OF PALEOMAMMALOGY; AND STEPHANIE SMITH,
PHD, BASS DISTINGUISHED POSTDOCTORAL
FELLOW, NEGAUNEE INTEGRATIVE RESEARCH
CENTER

Natural history collections include millions of specimens that are all scientifically valuable for a variety of reasons. Some of those specimens come from zoos, having lived and died in captivity before finding a home at the museum. Many of these captive specimens date back to the mid 20th century when animal husbandry practices were far less advanced than they are today. One of the many valuable things these specimens can teach us is how captivity impacts an animal's skeletal system, so zoos and other institutions can continue to improve their practices.

Trabecular bone is a spongy tissue that serves as scaffolding-like support within the bones of many vertebrates. The structure of trabecular bone changes throughout an animal's lifetime based on several external factors such as environment, activity, and diet. New advances in CT-scanning and computing techniques now allow us to quantify the structure of trabecular bone, which can help us understand the life an animal led based solely on its skeleton.

Life in captivity differs greatly from life in the wild. Captive animals are fed different diets, behave differently, often live longer than their wild counterparts, and can also have unique diseases due to their captive environment. Because all these factors can have an impact on the growth of trabecular bone, we can learn about the life of an animal raised in captivity.

Our team examined the difference between the trabecular bone of the vertebrae of captive and wild specimens in a group of mammals including sloths, armadillos, and anteaters (*Superorder Xenarthra*). We found that trabecular bone structure not only differs between captive and wild specimens, but that



this difference depends on the animal. More active animals, like armadillos, had a more distinct difference in their trabecular bone than less active animals, like sloths. We also found that every captive specimen of the lesser anteater (also called the tamandua) had a severe bone disease called vertebral hyperostosis. This disease, caused by an excess of vitamin D in the diet, caused excess bone to grow on their vertebrae and ribs, ultimately causing paralysis and death. Vertebral hyperostosis also caused changes in their trabeculae, making them thicker and less organized than

in their wild counterparts. Overall, we found that captivity has an impact on the internal bone structure of the vertebrae of sloths, armadillos, and anteaters, but this difference changes depending on the ecology and diseases of the animal. Captivity status is important for future studies of trabecular bone that use museum specimens.

(Above) 3D model of a nine-banded armadillo (*Dasypus novemcinctus*) vertebra with volumes of interest highlighted displaying trabecular bone.

FIELD LOYALTY CLASS OF 2021

The Field Museum is grateful to all members of the Field Loyalty Club. Their 20-plus years of dedicated philanthropy have allowed the Museum to be a global leader in science. This list reflects members and donors who achieved 20 years of giving in 2021.

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FIELD LOYALTY CLUB SPOTLIGHT:

Sylvia Furner, PhD

Field Explorer

2021 Field Loyalty Club Inductee

The Field Loyalty Club celebrates members in our community who have supported the Field Museum for over 20 years. Today, we celebrate Dr. Sylvia Furner, who joined this special donor community in 2021.

Sylvia vividly recalls visiting the Museum to see SUE for the first time in 2000 when the world's largest and most complete *Tyrannosaurus rex* specimen made a dramatic debut in Stanley Field Hall. She's always been touched by the awe in children's eyes and she cares deeply about all children having the opportunity to experience and catch inspiration from the Field Museum.

Sylvia has found many fascinating reasons to continue her support throughout the years. As an animal lover, avid traveler, and Associate Professor Emerita of Epidemiology at The University of Illinois Chicago with special interest in public health, she deeply values the lessons we can gain from studying the past. In fact, what Sylvia enjoys most about supporting the Museum is having a direct impact on sharing what the Museum has to offer with the broader community.

In addition to her philanthropic support, Dr. Furner is celebrating her 5th year as a volunteer for botanical research. Coincidentally curiosity for the natural world and pursuing scientific advancement runs in her family. Her daughter-in-law Bethany Elkington, PhD is an Ethnobotanist conducting research at the Museum on medicinal plants.

Sylvia cherishes the Field Museum and wants to ensure the institution thrives and sparks curiosity for generations to come. Her consistent support has made significant advances in education, research, and visitor experiences. We are grateful for her loyal support and for all of our Field Loyalty Club members!

Member Opportunities



badOhA gOshtE EaPnA Ok u by Missy Mahan

BEHIND THE ARTWORK: MISSY MAHAN

Wednesday November 9, 2022, 6:30–7:30 pm
Recommended for ages 16 and up

Native Truths: Our Voices, Our Stories features amazing work by Native artists from all over North America, including Missy Mahan (Tohono O'odham, Euchee (Yuchi), and Mvskoke). Join us for a virtual discussion with the artist and learn how she highlighted her culture in *Native Truths: Our Voices, Our Stories* with her own artwork and regalia presented alongside pieces from the Field Museum's anthropology collection. In collaboration with Field Museum collections, conservation, and mount shop staff, Missy's presentation will discuss how cultural materials come out of storage in the Collections Resource Center and go on display for the world to see!



MISSY MAHAN

PEGGY MACNAMARA

FROM THE SEASHORE TO THE SEAFLOOR

Wednesday, December 7, 2022, 6:30–7:30 pm
Recommended for ages 16 and up

Do you love the beach but don't know much about the oceans? Learn about them with Associate Curator of Invertebrate Zoology, Janet Voight and Field Museum Artist-in-residence, Peggy Macnamara as they talk about familiar and exotic marine areas reported in their recent book, *From the Seashore to the Seafloor*!

Also a perfect holiday gift for the sea-expert in your life! Visit the store.fieldmuseum.org to purchase your copy today.



HOLIDAY LOUNGE

During the week of December 26, 2022 through January 1, 2023, the Founders' Room will be open for donors and members. Stop in for a light refreshment, table activities for the family, or just to take a break and reflect on your visit.

Museum Hours

The Field Museum is open from 9am–5pm every day except Thanksgiving and Christmas Day, with last admission at 4pm. For special hours, parking, and public transportation options, visit fieldmuseum.org/visit.



The Field Museum salutes the people of Chicago for their long-standing support of the Museum through the Chicago Park District.



Official Airline of the Field Museum



This program is partially supported by a grant from the Illinois Arts Council Agency.



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Purchase a gift membership today and save 15% on your gift using the promo code **GIFTMEM15***! Gift recipients have 90 days from the purchase date to activate their membership, so they can begin their journeys of exploration. To learn more about our gift memberships, send your questions to membership@fieldmuseum.org or call us at 312.665.7700. Thank you for your continued support of science and conservation.

*This offer can only be applied to Field Museum Gift Memberships (Individual, Family, and Family Plus Memberships).



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